lie in the suppression of the assimilative process. Mr. Sorby's observations on the colour of plants are also given.—In physics and chemistry, we have an account of experiments by M. Meyer as to the influence of access of air on alcoholic fermentation, MM. Favre and Valson's researches on work done in saline solutions, those of M. Edlund on the electromotive and thermoelectric forces of metallic alloys with copper, those of MM. Mach and Fischer on reflection and refraction of sound, Prof. Maxwell's lecture on molecules, and other papers.—In a physiological paper, entitled "The internal mechanics of nerves," some additional light is thrown by M. Bernstein on the electrotonic state investigated by Pflüger, and a hypothesis is offered, to account for the phenomena. There are also biological papers on the apparatuses for production of sound in insects, and on the deep-sea fauna of the Swiss lakes.—We further note an interesting lecture by M. Sandberger, on a portion of the geological history of the *Oberrheinthal*; and a quantity of valuable information in the *Kleinere Mittheilungen*.

Journal of the Franklin Institute, Dec. 1873.—In this number are given two reports of the Committee on the mode of determining the horse-power of steam boilers. A division of opinion is indicated, a minority in the Committee holding, that the horse-power of boilers for stationary engines is properly defined as the capability to evaporate a cubic foot of water per hour from and at the temperature of 212° F. and there is no reason for modifying its normal value; while the majority (4 against 3), consider, that, in view of variations of capacity of the same boiler under varied conditions, the discontinuance of the term horse-power, as descriptive of the size and capacity of the boiler, is advisable; purchasers and makers should, instead, describe fully and in accurate terms, the evaporative capacity of boilers poposed, and the conditions under which they are worked and tested. Considerations are urged in support of each of these views.—Mr. Richards continues his "Principles of shop manipulation, for engineering apprentices;" this part treating chiefly of the various kinds of motive machinery.—A paper read by Mr. Ransome before the Franklin Institute gives an account of the improvements which he has introduced into the manufacture of artificial stone.—We also find notes on a new hydraulic railway car-brake, by Mr. Henderson, and on the stability of towers and chimneys, by Mr. Evans.—Among the "Items and Novelties" reference is made to some important results obtained by Prof. Thurston, from experiments at the Stevens Institute of Technology, as to the behaviour of metals under stress. The following deduction was repeatedly confirmed:—Metal strained so far as to take a permanent set, and left under the stress producing it, gains in power of resistance up to a limit of time, which in these experiments was about seventy-two hours, and to a limit of increase which has a value, in the best iron, of about 20 per cent., where the applied force is 80 per cent. of the ultimate breaking force.

SOCIETIES AND ACADEMIES

LONDON

Mathematical Society, Jan. 8.—Dr. Hirst, F.R.S., president, in the chair.—Mr. J. W. L. Glaisher read a paper on the transformation of continued products into continued fractions. The paper had its origin in a remarkable continued fraction for π given by Prof. Sylvester in the Philosophical Transactions for 1869, viz.:—

$$\frac{\pi}{2} = 1 + \cfrac{1}{1 + \cfrac{1 \cdot 2}{1 + \cfrac{2 \cdot 3}{1 + \cfrac{3 \cdot 4}{1 + \cfrac{4 \cdot 5}{1 + \&c.}}}}}$$

which is there shown to be equivalent to Wallis's formulæ—

$$\frac{\pi}{2} = \frac{2 \cdot 2 \cdot 4 \cdot 4 \cdot 6 \cdot 6 \cdot 8 \cdot 8 \ldots}{1 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 7 \cdot 7 \cdot 9 \ldots}$$

Prof. Sylvester arrived at his result by means of a complete solution he had previously found of the equation of finite differences

$$U_{x+1} = \frac{U_x}{x} + U_{x-1}$$

(a "shaving" as the discoverer remarked from his method of "reducible cyclodes") whereas the present paper arrives at the result by a direct transformation.—Prof. Clifford spoke upon the foundations of the differential calculus and of dynamics. The points dwelt upon were—all continuous quantity is expressed by lines, therefore every fluxion is really velocity or the method of fluxions and the beginning of kinematic is the same; he then dwelt upon Newton's definition of tangents and Hankel's remark, and pointed out the necessity of a modification of the definition, traced out certain analogies to the methods of Euclid and Archimedes (definition of fourth proportional and of area), and closed his remarks with a proof of the composition of velocities.—The secretary read a note from Prof. Crofton on a method of treating the kinematical question of the most general displacement of a solid in space.—Mr. Perigal made a few remarks on the subject of link trammels (in connection with Prof. Sylvester's recent paper), in the course of which he stated that Peaucillier's lozenge-trammel is a modified reproduction of Jopling's "double cranks" trammel, invented about 1822. The statement was impugned by Prof. Sylvester and Mr. S. Roberts.—The following papers were taken as read:—On Hamilton's characteristic function for a narrow beam of light, by Prof. J. Clerk-Maxwell.—Preliminary account of investigations on the free motion of a solid in elliptic space, by Prof. Clifford.

Geological Society, Jan. 7.—Prof. Ramsay, V.P.R.S., Vice-President, in the chair. The following communications were read:—1. "The Origin of some of the Lake-basins of Cumberland."—First Paper. By J. Clifton Ward, F.G.S. After referring to the fact that the question of the origin of lake-basins cannot be satisfactorily discussed unless the depth of the lakes and the heights of the mountains are brought before the mind's eye in their natural proportions, the author sketched out the physical geography of the lakes under discussion (Derwentwater, Bassenthwaite, Buttermere, Crummock, and Loweswater), and pointed out what must have been their original size and shape before they were filled up to the extent they now are. These lakes were not moraine-dammed, but true rock-basins. The belief that the present Lake-district scenery was the result of the sculpturing of atmospheric powers, such as we see now in operation, varied by climatal changes and changes in the height of the district above the sea, was enforced, and the opinion given that the work of elaboration of the lake-country scenery has been going on ever since Carboniferous or pre-Carboniferous times. When all the evidence was considered—the fact of the lake-hollows under examination being but long shallow troughs, the thickness of the ice which moved along the valleys in which the lakes now lie, the agreement of the deepest parts of the lakes with the points at which, from the confluence of several ice-streams and the narrowing of the valley, the onward pressure of the ice must have been greatest,—the conclusion was arrived at that Prof. Ramsay's theory was fully supported by these cases, and that the immediate cause of the present lake-basins was the onward movement of the old glaciers, ploughing up their beds to this slight depth.—2. "On the Traces of a Great Ice-sheet in the Southern part of the Lake-district and in North Wales." By D. Mackintosh, F.G.S. In this paper the author brought forward the evidence which seems to him to establish the existence in the southern part of the Lake-district of a "valley-ignoring and ridge-concealing ice-sheet." He gave a table of the direction of ice-marks observed by him in the Lake-district, and stated that about Windermere and Ambleside the general direction is nearly N.N.W., round Grasmere between N.W. and N.N.W., north-west and west of Grasmere in upland valleys and on high ridges about N. 30° W., south of Grasmere and in Great Langdale N. 35° W., and in the Coniston district a little W. of N. In many places he recognised an uphill march of the ice. The author also referred to the glaciation of North Wales, some of the marks of which, observed by him in a district south of Snowdon, seemed to him to indicate the southerly movement of a great ice-sheet capable of ignoring or crossing deep valleys.—3. Notes on some Lamellibranchs from the Budleigh-Salterton Pebbles. By Arthur Wyatt Edgell, F.G.S.

Linnean Society, Jan. 15.—Mr. George Bentham, F.R.S., in the chair.—Dr. Hooker, Pres. R.S., exhibited a very beautiful series of specimens of Fossil Copal, the product of *Trachylobium Hornemannianum*, some specimens of Recent Copal from the same plant, and some fruits of a *Momordica*, all fowarded from Zanzibar, by Dr. Kirk, F.L.S., for the Kew Museum.—Before proceeding to the regular business of the Society, the president again read, and explained the purport of, the alterations in the Bye-laws agreed to by the Council. The proposed alterations were adopted by the Society. The following papers were then read, viz. :—On some Species of Japanese Marine Shells and Fishes which inhabit also the North Atlantic, by J. Gwyn Jeffreys, F.R.S. The mollusca noticed by the author were procured by Captain St. John in H.M.S. *Sylvia*, during the years 1871 and 1872, on the coasts of North Japan. His dredgings varied betweeen 3 and 100 fathoms. After passing in review the works of naturalists who had described the marine shells of Japan, and especially the "Mollusca Japonica" by Dr. Lischke, with reference to those species which are common to Japan and Europe, Mr. Jeffreys proposed to record from Captain St. John's dredgings thirty-nine species, and to give the range of depth for such of them as he had obtained in the *Porcupine* expeditions of 1869 and 1870. He then offered an explanation of the occurrence of the same species in the Atlantic and Pacific Oceans, by suggesting that it was probably owing to involuntary transport by tides and currents, and not to voluntary migration. Very little is known about the direction and force of deep sea currents; but high northern species might be transported on the one side to Japan, and on the other to Europe, by a bifurcation of the great Arctic current, which has been traced as far south as the Straits of Gibraltar in the course of the *Porcupine* expeditions. The entry of northern species into the Mediterranean may be accounted for by the former existence of a wide channel, or rather an open sea between the lower part of the Bay of Biscay and the Gulf of Lyons, which has been satisfactorily proved, on geological grounds, to have been formed since the Tertiary epoch. A list of the mollusca referred to in the paper was given, with critical remarks, as well as a list of twenty-two species of fish which Dr. Günther communicated as common to the Japanese Seas and the North Atlantic or Mediterranean.—Dr. Carpenter, F.R.S., made some general remarks on Ocean-currents, especially with reference to the zones of temperature in the North and South Atlantic. He stated that it has been ascertained that water of 40° F. comes nearer to the surface in the equatorial regions than in the north and south temperate zones. There are, he believes, zones of all temperatures in all deep seas, such as that of 33° F. observed by Capt. St. John between Socotra and the Seychelles. He hoped that Capt. St. John would, in his future expeditions, be able to obtain a very valuable series of observations of deep-sea temperatures. Dr. G. J. Allman, F.R.S., said the specimens all belonged to types hitherto considered extinct; and he entered into some description of one of the most remarkable forms.—Note on Japanese Brachiopoda, by Thomas Davidson, F.R.S., communicated by J. Gwyn Jeffreys, F.R.S.

Chemical Society, Jan. 15.—Prof. Odling, F.R.S., president, in the chair. Mr. W. C. Roberts handed in a table supplementary to his paper read at the last meeting, and containing complete analyses of all the standard trial plates still extant, dating from A.D. 1477, namely, 17 gold plates and 14 silver ones.—The first paper was "On the action of trichloracetyl chloride on Amines : I. Action on aniline," by Dr. D. Tommasi and Mr. R. Meldola. This reaction gives rise to a substance callen *phenyl-triacetamide*, which crystallises in lustrous plates. It is acted on by nitric acid with production of *dinitrophenyl-triacetamide* crystallising in yellow needles.—Dr. H. E. Armstrong read a note "On the action of sodic ethylate on ethylic oxalate and other ethereal salts."—"On the products of decomposition of castor oil : I. Sebacid acid," by Mr. E. Neison. An account of the preparation and properties of pure sebacic acid, and of many of its salts.

Geologists' Association, Jan. 2.—Henry Woodward, F.R.S., president, in the chair.—On the nature and formation of Flint and allied bodies, by Mr. M Hawkins Johnson. The object of the paper was to show the nature of several members of a large group of bodies occurring in sedimentary deposits of different ages, and which are generally known as nodules, and described as concretionary. Those specially alluded to were the septaria from the London and Kimmeridge clays, the flints from the chalk, the iron pyrites from the chalk, the phosphatic nodules from the gault, the clay ironstone nodules from the carboniferous series, and the ironstone from the Woolwich beds. By the gentle action of solvents the structure of these bodies is revealed so as to be easily examined by the microscope. They are thus found all to agree in possessing a silicified organic structure, which may be described as a net-work of fibres or a mass permeated in every direction by anastomosing canals. This structure was subsequently filled in with other material, such as carbonate of lime, silica, bisulphide of iron, phosphate of lime, carbonate of iron, &c., the particular substance thus filled in depending upon the relative abundance of the substance dissolved in the interstitial water of the surrounding matrix. The singular group of concentric siliceous circular bands seen upon many fossils, and known as orbicular silica, or Beekite markings, were also explained. The fossils on which they occur are imbedded in a matrix more porous than themselves and of irregular constitution, so that the evaporation, to which the consolidation of the dissolved silica in their pores was mainly due, occurred at a number of points on the surface of the fossil, at which points a deposit of silica took place forming the central tubercles. The cessation of evaporation was followed by a fresh saturation, with the solution to be again evaporated. But as the evaporating points were now plugged up by the previous deposits, the silica last consolidated was deposited around their margin and upon them internally appearing outwardly as a ring round the tubercles. Alternations of these conditions account for the numerous bands seen in some of the groups.

Anthropological Institute, January 13.—Prof. Busk, F.R.S., president, in the chair.—A paper, by Mr. S. E Peal, was read, on the "Nagas and neighbouring tribes." The tract of country occupied by the Nagas lies mainly between lat. 25° N. to 27° 30′ N., and long. 93° 30′ E. to 96° E. It is bounded on the east by the country of the Singphus or Tsingpos, a distinct race showing strongly-marked differences in language, physique, and customs; on the north by Assam; and on the west are various other tribes, while to the south the boundary is undefined. The inhabitants of the tract, although all termed Nagas, are divided and sub-divided to so great an extent that few parts of the world can present such a minute segregation of innumerable and independent tribes. A common and conspicuous feature of the Nagas, Garos, Kukis, Lushais, and other hill-races of that district, is their custom of taking human heads either by regular warfare, raids, or casual surprises. Not only is the custom general among them, but it has obviously existed for a long period of time, and, in its present phase, is the true cause of the strongly-marked variations both in language and physique that exist among the Naga tribes, no two of whom are really alike. An almost necessary consequence of this mode of life is that they are a fine, hardy, active race, excelling in all that relates to forest lore and labour, while, on the other hand, they are conspicuously deficient in the arts of pottery, working in metals, and writing. The most singular feature is, perhaps, the almost total absence of agricultural implements; everything is done with the Daú, or P-shaped axe. The mental capacity of the Nagas is low, although they exhibit smartness or cunning in matters relating to ordinary life; no individual known to the author was able to count beyond ten.—Mr. C. B. Clarke contributed a paper on the "Stone Monuments of the Khasi Hills." The Khasi Hills form a plateau, at a mean elevation of 4,500 feet above the sea, between the plains of Assam on the north, and Sylhet on the south, and are inhabited by a people quite distinct from the neighbouring Hindus. The stones, which are profusely scattered over the range of hills are of three kinds : the funeral pyres, the kists containing the jars of ashes, and the monumental groups. One great feature of the Khasi sepulture is, that the ashes of the family are collected from time to time. At first the ashes of a man are kept in a small kist, then, after a few years, a great funeral ceremony is held, and the ashes of the various individuals of the family are collected from the smaller kists. The ashes of all the men are collected into one earthen jar, those of the women into another, and these two jars are placed in one large kist; the jar of the women's ashes is placed next the last stone closed, for the reason that among the Khasi the woman is always mistress of the house.

RIGA

Society of Naturalists, Aug. 27—Dr. Buhse presented some growing specimens of *Elodea Canadensis*, the American aquatic weed which, since 1836, has appeared and spread over Middle and Northern Europe; and gave some account of it. Two different analyses of the weed, by Fischer and Liebig, show a large proportion of salts in its ashes, and also how widely the proportion of its constituents varies with the nature of the water in which the plant grows.

Sept. 17—M. Schweder directed attention to a fossil egg now in the St. Petersburg Museum. It was found in the Chersonese Government a few years ago, and has been secured for 1,000 roubles (say 166*l*.). It is 18 cm. length, and 15 cm. short diameter; its capacity is reckoned equal to that of 40 to 44 hen's eggs. It is thus larger than an ostrich egg, but much smaller than the egg of the Epiornis, which is equal to 148 hen's eggs.—Various plants and other specimens were presented.

VIENNA

Imperial Academy of Sciences, Nov. 6.—Prof. Mach presented a paper on physical experiments as to the sense of equilibrium in man. From experiments on himself, he is led to think that Flourens' turning phenomena, the orientation of equilibrium and of motion, the phenomena of giddiness, certain optical movements, &c., may be explained by supposing that the nerves of the ampullæ of the semicircular canals respond to every stimulus (which commonly involves a turning of the contents of the canal), with a sensation of turning.—Dr. Boué gave results of 33 years' observations on the circumstances attracting lightning strokes. He points out that the lightning often strikes low objects, though higher may be nearer; and he considers that constancy of course, in thunder clouds (from presence of mountain chains, &c.) and repeated discharges at particular points, may afford an explanation, in the superior attraction, viz. of subterranean masses of metal in certain regions.—Prof. Niemtschik made a communication on the construction of an ellipse inscribed in a circle, centre and tangent being given.

Nov. 13.—Prof. Pfaundler described three forms of apparatus he had devised for showing the composition of vibrations occurring at right angles to each other.—M. Stefan gave a paper on evaporation, examining theoretically the experiments lately described. From the formulæ of his dynamical theory of gases, he calculates the mean courses of the vapour-molecules of ether and sulphuretted hydrogen from one collision to the next; these are 23 and 32 respectively, the millionth part of a millimetre being taken as unit; also, from these, the diameter of the molecules; which are 0·9 and 0·7.

Nov. 20.—M. Puschl presented a paper on the co-motion (*Mitbewegung*) of light in moved media. He states the following conclusions: (1) Through participation of the ponderable atoms in propagation of light, the latter may, in various bodies, be more or less retarded, but in no case is it considerably accelerated. (2) The specific refractive power of a body is connected with the substance of its atoms, and independent of its density, so long as the internal nature of the atom substance remains the same. (3) The internal nature of atoms is modifiable through external pressure, crystallisation, solution, mixture, and especially chemical action. (4) The ether waves sent out from substances themselves are not produced immediately through the motions of the atoms as a whole, but mediately, through corresponding disturbances and concussions of the atom substance, which vibrates in the periods natural to it, according to the specific elasticity and the dimensions of the atoms.—Prof. Luess read a paper on the earthquakes of Southern Italy. He specified some points, in Sicily, and neighbouring islands, from which shocks spread radially in various directions (Etna, however, not being one of these centres); in other cases the earthquakes seemed to take a quite irregular course.—Dr. Weiss made some observations tending to identify the comet lately discovered by Coggia and Winnecke with Comet 1818 I.—M. Payer presented some fossils brought by the Weyprecht expedition from Spitzbergen.

BOSTON, U.S.

Natural History Society, Nov. 19, 1873.—Mr. F. W. Putman gave an account of the anatomy of *Bdellostoma*, and compared it with that of *Myxine* (known as hag-fish), illustrating his remarks with series of dissections, showing the brain, skeleton, intestine, ovary, liver, heart, branchial sacs, &c. These two genera of fishes form the family of *Myxinidæ*, and have similar habits and a very close external resemblance, although they can be readily distinguished by the number and position of the brandial outlets, and by the position of the œsophageal duct. Mr. Putnam said that his dissections, though in great part repetitions of those of Müller, made over thirty years ago, showed conclusively the natural separation of the genera by their internal structure.—Mr. L. S. Burbank read a paper on the "Surface Geology of North Carolina," with especial reference to some phenomena of Northern drift. From the facts noted the following inferences may be drawn:—(1) The time which has elapsed since the close of the drift period must be very short compared with the previous ages, during which the solid ledges were disintegrated by chemical and atmospheric agencies. 2) Boulders of the drift do not, in general, owe their rounded forms to attrition by glacial action, but, while still in place, assumed these forms by disintegration and exfoliation. (3) Whatever the force or agency of the drift may have been, it did not produce the great mass of the drift material by mechanical action in wearing and grinding down the solid rocks, but has merely carried forward and commingled the materials already disintegrated.—The secretary read an extract from a letter dated St. John's, Newfoundland, Nov. 10, 1873, from Mr. Alexander Murray, the geologist of Newfoundland, to Professor Jules Marcou, giving an account of a remarkable marine monster, which recently made its appearance off the shores of that island, and of a severed arm or tentacle of the same in his possession. The tentacle measured on October 31, having then been several days in strong brine and shrunk in consequence, seventeen feet, but was said to have measured nineteen feet previously.

PARIS

Academy of Sciences, Jan. 12—M. Bertrand in the chair.—The following papers were read:—Tables of Jupiter, by M. U. J. Leverrier. The author finds that the influence of all the small planets on Jupiter is inappreciable.—Third memoir on chemical dynamics, by M. Becquerel. This paper dealt with the action of water in chemical combinations and with the effects of water and other liquids acting as electrodes.—On the distribution of magnetism in soft iron, by M. Jamin.—On the heat set free by the combination of nitrogen with oxygen, by M. Berthelot.—On the osteology of the anterior limbs of the *Ornithorhyncus*, &c., as compared with that of the corresponding members of reptiles, birds, and mammalia, by M. Ch. Martins.—On the problem of three bodies, by M. F. Siacci.—Studies on diffraction, by M. A. Cornu. The author gave a method for the geometrical discussion of diffraction problems.—On the physiology of the flight of birds in relation to the action of the wing on the air, by M. Marey.—Organogenesis compared with androgenesis (*l'androcée*) in its relation with natural affinities (class of *Cruciferæ*), by M. Ad. Chatin.—On the transformation of the vibroscope into a tonometer, and on its use for determining the absolute number of vibrations, by M. A. Terquem.—On chloral and its combinations with albuminous substances, by M. J. Personne.—On an acoustic pyrometer, by M. J. Chautard. This instrument depends on the variation of wave-length of a sonorous wave when the vibrating air is heated.—On a re-agent paper for detecting urea, by M. Musculus.—On the formation of gum in fruit trees, by M. Ed. Prillieux.—Researches on the glands of *Rosa rubiginosa* and on their contents, by M. R. Guérin.—On the geometrical properties of rational fractions, by M. F. Lucas.—On theorems of indeterminate analysis, by Father Pepin.—On the action of definite ternary systems compounded of mannite, borax, and water on polarised light, by M. L. Vignon.—On the artificial production of crystals of calcic oxalate resembling those produced by plants, by M. Vesque. The method consisted in causing solutions of potassic oxalate and calcic chloride to mingle very slowly in a third neutral liquid by causing them to flow through strips of blotting paper, or one solution and the neutral liquid were mixed and the other introduced in the same way, or the solutions were diffused into each other through a dialyser.—Notes on the storms of the year 1869, by M. Fron.

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ERRATUM.—Vol. ix. p. 128, 1st col. line 35, for "18 degrees" read "180 degrees."